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## MY STRUGGLE WITH THE ITALIAN LANGUAGE AND THE MORALS I DREW FROM IT FOR THE TEACH- ING OF MATHEMATICS

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J. W. A. YOUNG  
University of Chicago

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Not the least of the advantages which the summer sessions of quite a number of our universities have offered teachers has been the mere fact of sitting once more in the classroom as learners; the opportunity, after much experience in teaching, of again passing through the process of being taught. Good teachers are constantly trying to appreciate the point of view of their pupils, and as constantly realizing how imperfectly, in the very nature of things, they can ever hope to succeed. But actually to enter the classroom again as a student, day after day and week after week, certainly gives the teacher a more vivid and real picture of the attitude of mind of his own pupils than could any imagining in his study or at the teacher's desk. True, it no more gives him a reproduction of the youthful mental processes than a later ocean voyage can reproduce the indescribable charm and novelty of the first, but it unquestionably brings him a long step nearer to realizing what these mental processes must be.

The teachers of whom I have been speaking study, perhaps without exception, advanced work in the field in which they have already taught. A still closer approach to the position of the pupil would be made if the teacher were to take up some new subject as a *beginner*.

This opportunity came to me a few months ago when I began the study of Italian. Intent only on getting a practical start in the language as rapidly and easily as I could, I was perhaps transplanted, as nearly as is now possible for me, to the position of the secondary-school pupil, and in the course of the work a number of my experiences forced me to think of the beginner in mathematics and of how he should be taught in analogous cases.

The wide divergence in matter, method, and purpose of study between mathematics and conversational Italian is obvious; still the fundamental acts of learning are sufficiently similar to compel me to give certain measures of weight to the mathematical morals drawn. What that measure of weight should be, each reader may determine for himself.

By no means do all the inferences corroborate the views I have already formed as to the teaching of mathematics, and when they do not, the diversity of the subjects is especially comforting.

1. *The beginning.*—My beginning was not with simple but useless and colorless sentences like "The man is tall," "The fire is hot," which teach only words, but with a long phrase, packed full of idiomatic expressions, having indicatives, subjunctives, potentials, infinitives, and the various parts of speech, all in evidence; given without vocabulary or grammatical explanations, but simply with a free and a word-for-word translation, together with the pronunciation of the Italian. The novelty of the whole impressed this phrase indelibly upon my mind without any effort, and its characteristic idioms came into constant use as soon as I had occasion to speak Italian.

Could we not in mathematics utilize the lasting character of first impressions more fully than we do? Could we not in the very first class exercise take up a characteristic example that would get to the heart of the subject or topic, show what it is good for? Does not this fix in the mind of the pupil some of the things we wish him to have constantly at hand, better than if the first exercise is devoted to a preliminary discussion of definitions and principles—putting up a scaffolding, as it were?

In other words, if house-building is to be taught to one who has never even seen a house, first *show* him a completed house, take him through it, let him see that a house is a good thing to have, and hence a good thing to build; next let him see what are the most obvious requisites for building a house; then the requisites for these, etc.

This will surely prove more effective than to say: "We propose to study house-building. The materials out of which a

house is constructed are: stones, sand, lime, hair, wood, iron, white lead, oil, colors, glass, etc., etc. The various sorts, qualities, and shapes of stone used are . . . . etc., etc."

2. *Not many* expressions were given, but those given were typical and flexible—models that could be adapted to many occasions. Whether I was seeking a permit from the minister of education, or whether I was explaining to a station master a complicated transaction on a train, it was surprising to find how aptly the models fitted in.

The mathematical moral is obvious. If the pupil masters well-chosen *types*, he will readily handle their variations, and other types of the same general character, when occasion arises. Let not the teacher think, for example, that he must, first and foremost, put his pupils through every possible "case" of factoring, or every conceivable style of problem in long division. If the pupils grasp the fundamental idea as exemplified in some well-chosen problems the rest will take care of itself. The growing range of knowledge of the subject and increasing dexterity in its manipulations will *of itself* furnish a wider field for application of the process in question.

3. *Few classified lists* of names of objects were given; no lists of colors, furniture, edibles, etc. Names are inevitably learned in dealing with the things themselves. The same is true in a large measure of verbs. What should be learned, through suitably selected examples, is the ready and idiomatic use of adverbs and prepositions, and this not in the artificially simple forms of the lesson-book, but in the somewhat complicated phrases of actual practice. In this connection many important nouns, adjectives, and verbs would also be learned.

So in mathematics, the aim should not be at once to define and master *all* the concepts and operations of the subject or topic in hand, but rather to learn to handle some of them effectively. This once accomplished, mere extension of the subject-matter is easy.

4. *The active phase* of the use of the language, the expression of my own thoughts, in some fashion or other, was decidedly easier than the more passive act of understanding the expressions

of others. Especial and prolonged effort was needed to train the ear to understand spoken Italian.

It is obvious that at this point no close parallel can be drawn with mathematics. The interpretation would, of course, be that the pupil along with his active work—thinking and expressing his own mathematical thoughts—should also receive extended training in grasping the mathematical ideas expressed by others. In the proper reaction from a mode of instruction in which the pupil was an entirely passive learner, some have gone to the opposite extreme and sought to have him grow all his mathematics himself. This plan surely achieves the ends of the study of mathematics better than the other, but perhaps a combination of both would really be the golden mean.

5. *Much reading* of all sorts—newspapers, manifestos on the walls, novels, plays, in which the aim was to get the essence without worrying about words and phrases not understood—did more than anything else to accomplish precisely that which was apparently neglected, namely, to enlarge my stock of words and phrases, and to give a feeling of acquaintance with the usages of the language.

This suggests the question whether the precision itself of mathematical attainment may not at times be best strengthened by not delaying to insist on mastery of all details; whether there are not in mathematics certain benefits which pupils can derive best by cursorily going over large quantities of mathematics, in their own reading, in hearing reports on work done by other members of the class and through sketches of various domains of mathematics given by the teacher.

6. *Paradigms, the dictionary, and grammatical rules* were incidental aids, not dominating ends. For example, after many instances of use of different forms of a verb, it was finally an aid, a simplification, to have them all drawn up in a classified table. On rare occasions, when the Italian equivalent of an English word was urgently needed, or when some Italian word aggravatingly persisted in not unmasking itself, the dictionary afforded relief. Rules of grammar described the linguistic usages already observed, just as the guidebook described the material

objects of interest already seen. And, like the guidebook, the rules of grammar often drew attention to things of interest which would otherwise have escaped notice.

In mathematics, likewise, definitions, rules, schematic enumeration of types and cases should be aids, not ends; useful outgrowths of the work, not the basis of it.

7. *The relation of Italian to French* was of value only indirectly. The very similarity of the two made it necessary to repress the French which had quite a footing in my mind, and when this was once done in a measure, it was difficult to resume it at a moment's notice. To illustrate: An Italian professor with whom I was conversing on educational questions, fearing that I was not following perfectly what he was saying, was good enough to turn the conversation into French, and, though I undoubtedly understood him better, I found to my great mortification that the French words which had been so obtrusive when not wanted, now refused to come at all.

In mathematics, we have of late years justly been laying much stress on closer relations between the various subjects which we in America have unpedagogically kept completely separated, not only in matter, but also in time. The experience just recorded is only an instance of the well-known fact that it is hard for the mind to turn from one subject to another, especially when the first is difficult and engrossing all the mind's energies. The mathematical subjects should surely be brought into closer connection, but not in a merely mechanical way. To turn from one to the other on the word of command, to give such days of the week to algebra and such to geometry, is an attempt that seems psychologically foredoomed to failure. The real interrelations between the subjects must be sought out and followed; the turn from one to the other made when there is inherent reason for doing so, and not arbitrarily; only so can the mental friction and loss of energy attendant upon diversion of unsatisfied attention from one field of thought to another be reduced, if not eliminated, and the hope cherished of bringing the various branches of secondary mathematics into their due relationship as parts of one great edifice.

8. In Italy, I took a few lessons, my beginning having been made in America by private study following an excellent book of exercises. I appreciate as keenly as anyone the paramount importance of the living teacher, but I also realized afresh that almost every teacher ought to make a good text a part of his work; such a part as his own experience and the needs of his pupils may dictate. The success of a course in Italian, like that of a course in mathematics, is largely made or marred by the selection of the materials; and it is clear that no teacher can give to such selection for one class or a few pupils the same thought, time, and labor that a writer will bestow upon a book intended for thousands of classes and tens of thousands of pupils.

9. I spoke at the outset of my "struggle" with Italian and such it would surely have been had I approached it by the door of grammatical system, trying to learn all possible forms before using any. As it was, theory being the handmaid of practice, the work was a pleasure throughout. The practical use that I might make of the language was not needed as a spur to work; but the pleasure of meeting and conquering difficulties, the consciousness of growing strength, the desire to see what was coming next, the opening-up of a new literature with its portrayal of the life and culture of a people hitherto known only at second hand, were sufficient incentives.

Mathematics, likewise, which many approach with forebodings of a dreary struggle, has even greater possibilities of interest. With its peculiarly satisfying type of mental activity, with its vast body of clear-cut and interesting facts, with its exemplifications on all hands in the material universe, mathematics may, if only here too theory be made the handmaid of practice, be so presented that even he who approaches it in the anticipation of a struggle shall leave it with recollections of pleasure.